

GILL (H. Z.)

Compliments of the Author.

ABSTRACT

OF THE

Report of the Special Committee on Croup

OF THE

ILLINOIS STATE MEDICAL SOCIETY,

WITH

A LIST OF EIGHTY-THREE CASES OF TRACHEOTOMY, FOR CROUP
AND DIPHTHERIA, PERFORMED IN THE
STATE OF ILLINOIS.

*Presented by
H. Z. Gill*

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LATE BREVET LT. COL., SURGEON U. S. VOLS.

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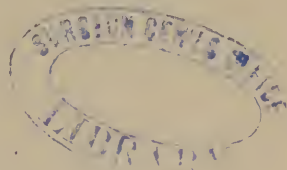
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[The abstract was made at the request of the State Society, and by vote of the Society the author was allowed to publish the full report himself, it being too lengthy for publication in the Transactions, the Society, by its By-Laws, otherwise claiming full possession of all papers presented to it. The full report, containing an extensive bibliography, statistics both home and foreign, and a discussion of the subject of unity or duality of croup and diphtheria, will be published soon, at the earnest request of many of the members of the Illinois State Medical Society. The correspondence with members of the profession within the State has been extensive, as well as with many outside, frequently amounting to several letters to the same individual, and the answers have been generally of the most cordial and interesting character, showing most clearly the importance of the subject.]

CROUP.—Latin eq., *angina trachealis*; French eq., *croup*; German eq., *der croup*.

SYNONYMS.—Angina canina, angina cruposa, angina exudatoria, angina inflammatoria, angina laryngea exudatoria, angina membranacea, angina membranacea trachealis, angina perniciosa, angina polyposa, angina polyposa sue membranacea,

angina pulposa, angina strangulatoria, angina strepitosa, angina suffocans, angina suffocatoria, asthma infantum, catarrhus trachealis, catarrhus suffocativus barbadensis, cauma bronchitis, cynanche laryngealis, cynanche trachealis, cynanche tracheo-laryngealis, cynanchorthopnœa, diphtheria (Bristow), diphtheritis trachealis, empresma bronchitis, empresma bronchlemmitis, expectoratio solida, laryngitis crouposa, laryngitis crouposa et diphtheritica, laryngitis catarrhosa, laryngitis et tracheitis infantilis, laryngitis diphtheritica, laryngo-tracheitis, laryngo-tracheitis crouposa, laryngo-stasis, laryngocœce, morbus strangulatorius, morbus suffocantus, morbus truculentus infantum, suffocatio stridula, trachitis, tracheitis membranosa, tracheitide infantum.

FRENCH.—Le croup ; angine couenneuse ; angine laryngée et trachéale ; angine trachéale diphtheritique ; diphtherie trachéale ; laryngite membraneuse, polypeuse ; laryngite pseudo-membraneuse ; laryngo-tracheite.

GERMAN.—Der croup ; die Häutige Bräune ; der Kehlkopfs-croup.

VULGAR.—Croup ; membranous croup, catarrhal croup, diphtheritic croup, pseudo-membranous croup, pseudo-membranous laryngitis, exudative laryngitis, inflammatory croup, true croup, malignant croup, roup, lives, choak, stuffing, rising of the lights.

DEFINITION.—By the term *croup*, I mean an acute, idiopathic, pseudo-membranous, inflammatory affection of the larynx or trachea ; accompanied with difficult or obstructed respiration, generally audible, especially during inspiration ; hoarseness, partial or entire loss of voice ; frequent, dry, ringing cough in the early stages ; more or less of spasm of the internal laryngeal muscles, producing paroxysms of aggravation of all the respiratory and vocal symptoms, often to apparent suffocation ; and frequently with expectoration of concretions of

plastic or pseudo-membranous material in the advanced stages of the disease.

The word croup is probably of Scotch origin, (*croup*, *crupe*, *crowp*, to cry or speak with a hoarse voice). It was first used by Dr. Vatrick Blair, of Cupar Angus, in 1713, and originally meant strangulation; but it was established in medical nomenclature by Dr. Francis Home, in 1765. Cook derives the name croup from the membrane which occurs on the tongue of young fowls, and which we call the pip.

Croup, then, in the present accepted sense, is an acute disease, generally sudden in its attack, rapid in its course, and of high mortality.

THE HISTORY OF CROUP

May be very conveniently divided into four epochs, or periods:

The first period embraces the time from the earliest medical records of disease to the date when Baillou found the cause of the attacks of suffocation, discovering the false membrane in the larynx and trachea, viz. in 1576.

The second period begins with Baillon's discovery and ends with 1765, the time of the publication of Dr. Francis Home's work, by which the disease became generally known by its present title, croup.

The third period extends from 1765 to the Napoleonic prize in 1808.

The fourth and last period comprises the time from 1808 to the present day.

That the disease which we call croup existed at a remote period, and was described by Hippocrates, scarcely admits of a doubt. Littré, in discussing the subject before the Academy of Medicine, at Paris, in 1861, gives an account of a disease which he says occurred in a village (Perinthe), in the north of

Greece, and which he calls the epidemic of Perinth. We give here the original description :

Fifteen or twenty days after the winter solstice, there occurred a form of cough which at first presented nothing peculiar ; but before the equinox which followed, the larger part of the patients had a relapse, which came on ordinarily about the fortieth day, counting from the beginning, and it was then that the disease assumed an unexpected character. Three orders of phenomena made their appearance—nyctalopia, angina, and paralysis. The paralysis was peculiar in having no accompanying cerebral symptoms. The patients died early, without obtaining any benefit from purging or bleeding.—*Hippoc. I., vi. Epid. transl. of Littré.*

Areteus also described a disease which could scarcely be other than croup. Galen also “saw a patient expel a thick viscid membrane which he took for the epiglottis. The child recovered.”—*Simon.*

The knowledge of the pathological anatomy of croup seems to have been obscure until 1576, when Baillou, of Paris, described the symptoms and anatomical characters. As in many other cases in medical science in early, as well, indeed, as in later times, the observation attracted little attention. In the years 1583, 1587, 1591, 1596, and from 1600 to 1605 croup prevailed in epidemic form in Spain, and then extended to Nap'les and Sicily, and in 1613 it returned to Spain with such increased malignancy that the year was called *ano del garotillo*, the year of strangulation. From this date we find Francesco Perez Cascalez noting the existence of the false membranes. Cristobal Perez Herrera also saw the false membranes upon the skin, and upon wounds, and found them in the throat, larynx, and trachea ; and this feature he regarded as characteristic of the disease, which he looked upon as malignant, pestilential and contagious. In 1665 Miguel Heredia distinguished two forms of the disease, one inflammatory and suffocating, the other asthenic, malignant, without asphyxia, destroying the patient by prostration. The paralysis of the soft palate, the pharynx and the extremities did not escape him, and he believed in the general poisoning of the system by absorption of the morbid products.

About the same time are to be found the detailed accounts of various epidemics, by Jean de Villareal, Alonzo Nunez de Pereira, Ildefonso Menezes, Jean de Soto, Francisco de Figueiroa, Lorenzo de San Milan, and Luiz Mercado. The last named reported a case in which the disease was communicated from a child who had died, to the father, when the latter was removing the false membrane from the fauces. In 1626 there was an epidemic in Portugal characterized by an inflammation of the throat, accompanied with malignant and corroding sores. Children were attacked and died in large numbers, while but few adults were attacked, and they generally recovered. In 1668, Thomaz Rodriguez de Veiga, a Portuguese professor at C6imbr6, spoke of angina laryngea, and he advised tracheotomy in desperate cases. Still another epidemic occurred in Portugal, mainly among the children, accompanied with a scarlatinous eruption and membranous patches, which he regarded as contagious. Soares Barbosa was himself attacked, and after trying ineffectually blood-letting, resorted to ipecac and tartar emetic exclusively.

Epidemics of croup and diphtheria prevailed about the same time in Italy, and Marc-Aurele Severin witnessed the presence of false membranes in the larynx. Entm6ller, Molloi, and Mallouine wrote on the disease, and after them Martin Ghisi (1747) described the disease as it occurred in epidemic form in children, and in some cases of which casts of the air passages were thrown off, and many died from the second to the fifth day. In the *post-mortem* of a son of the pharmacist Scotte, false membranes were found in the larynx by which a complete distinction could be made between angina laryngea and angina tonsillaris.—*Simon*.

One year later (Simon, or in 1749 Churchill) Star saw, during an epidemic, in the throats of several patients, false membranes which extended into the larynx, and were expectorated in long membranous tubes. He gave an illustration of one of these, showing the exact form of the larynx, trachea and pri-

mary divisions of the bronchial tubes. About the same period (1747) Arnault and Marteau (1768) observed the same facts. The malignant cases, when the disease reached the air-passages, produced a harsh cough, aphonia and false membranes which observers took for eschars. Thus Middleton, 1752, Bergius and Rudberg, 1755, Breghen, 1759, Wahlborn, 1761, Wilcke, 1764, wrote on the subject; and in Spain and Portugal there were numerous and important documents in which were described all the principal anatomical characteristics, as also the paralysis, scarlatinoid eruption; and the rational treatment—*tracheotomy*—was also pointed out.

The distinction between *true* and *false* croup was yet to be settled; and also the different characteristics of angina and their correspondence with diphtheria. Thus stood the case, and so ended the second period with 1764.

The third period commenced with the remarkable monograph—"An Inquiry into the Nature, Cause, and Treatment of the Croup," by Dr. Francis Home: Edinb. 1765. The writings previously had been rather fragmentary, of detailed character, but not systematic works. He established, as heretofore mentioned, the term "croup" in medical science, the name by which it is now generally known, both in and out of the profession. From this date writings multiplied. Diagnosis, especially the differential, became more accurate. Croup was no longer united with laryngeal asthma, Millar establishing the distinction; the latter disease not having plastic accretions, nor swelling of the neck, nor fever.

In 1766 Eller, in 1767 Engstrom, Rush and Millar in 1769, Crawford, Rosen and Samuel Bard in 1771, Calisen, Buchan, and Trumbull in 1776, Mahon in 1777, and Middleton in 1780, wrote on the subject. and in 1783 Vieussieux, of Geneva, made three divisions, viz., the nervous, the inflammatory, and the chronic.

But Samuel Bard attempted to demonstrate that angina gangrenosa, angina membranosa with croup, and croup *ab*

initeo (d'emblée) were not three separate diseases, but one and the same entity, manifesting itself in three different forms. In him we have thus early an American unitist. Schwilgué, of France, in 1801 made an analysis of the false membrane, and in 1808 he made a vast collection of material, some of which has been used in many later works.

In retrospecting these many facts, is it not surprising that the question of unity had not earlier attracted the attention of scientific minds, and become as largely accepted as it is now? Nothing scarcely seemed to be omitted in the study of the disease; it was known from the earliest history of medicine; the destructive epidemics of France, Spain, Portugal, Italy, Scotland, England, Sweden, and other Northern countries gave the saddest evidence of its existence; observation led to the separation of the pharyngeal and laryngeal forms. Home described the pseudo-membranous affections of the trachea and and of the larynx—croup distinct and separate; Millar, Fleisch, Henke, Wendt and others, pushing their observations still farther, described distinctly the laryngeal spasm, our false croup; finally, Bard included under the same title the various diphtheritic manifestations produced upon the pharynx, the larynx, or the two simultaneously. But to sum up, croup, laryngitis stridulosa, and diphtheria were known; the truth, however, was not popularized at the close of this third period, 1807.

The fourth period commences with the prize of Napoleon, in 1808, and extends to the present day. This prize was occasioned by death, from croup, of the eldest son of Louis Bonaparte, in 1806. The news of this sad event being brought to Napoleon, he instituted at once the commission for the competition, to which he invited physicians of all countries, in order to obtain a complete knowledge of the subject; and for the best memoir on the nature and treatment of croup, he offered a prize of twelve thousand francs.

The united intellects and labors of two foreigners, Jnrine and Albers, of Bremen, bore away and divided the prize. About this time, or up to 1812, several important works appeared, among which may be mentioned that by Royer-Collard, Sec-

retary of the Prize Commission, and author of the article "Croup," in *Dictionnaire des Sciences Medicales*; and that by Caron (1808), who vehemently advocated tracheotomy; and the one by Valentine (1812), who collected all the facts, historical and practical, within his reach. The nature of the disease, as to its unity or complexity, came again to the surface. One held that each was a *single inflammation* of exaggerated degree. Another, while taking full account of the inflammatory factor, recalled also the powerful additional nervous element; and a third held to the physiological doctrine for an explanation.

Bland concluded, from a great array of facts, that croup was at one time a catarrhal, at another a purulent, and again a pseudo-membranous inflammation. Jurine, one of the successful competitors for the Napoleonic prize, expressed some doubt about the gangrenous nature of the false membrane, the same as Bard had done, and admitted that angina might exist either alone or with the croup, and that the false membrane might extend into the trachea, but also recognized the bond that united these various affections. For him the seat alone established the difference of manifestation of one and the same malady.

These views did not yet gain ready acceptance, but the later observations of Bretonneau (1818), in an epidemic of malignant angina at Vendee, showed that this latter disease should not be so designated, since the false membrane alone constituted its characteristic, and that croup was equally a pseudo-membranous affection with the angina membranosa, and dependant upon the same cause. This distinguished observer studied the disease in all its manifestations and phases, pathological and chemical, following it by dissection from the nasal fossæ to the lungs; and, concluding there was a unity as to cause with a general manifestation, he called it diphtheria; but the Germans, at least many of them, have diverted this term from its original sense, as definitely set forth by the author. He believed he had made a real discovery, and, as a consequence, the treatment was di-

*Sig Øega
membrane.*

rected largely against the local manifestation with the greatest hopes; and in the same line of reasoning he was led to practice *tracheotomy*, of which Caron had previously been such an ardent advocate.

Bretonneau, so firm in the correctness of his conclusions, drawn from such an extensive experience, proceeded to put into practice his theory, and performed tracheotomy five times, "with but sad partial success." Finally, in the case of the daughter of a friend (the child, Elizabeth de Puysegur), recognizing *the commencement of asphyxia* by the signs given by Aretæus more than seventeen centuries before, he operated and saved the child "from certain death." To this great man, it seems to me, must be accorded the distinguished honor of having established tracheotomy in the treatment of croup, popularizing it, and creating the fire at which his followers, such as Trousseau and others, have lighted their torches.

The views of Millar and Weichman were again brought forward, Bretonneau calling all the cases of laryngitis suffocantis, of either inflammatory or nervous character, *laryngitis stridulosa*, in which was found no trace of false membrane; and Guersant gave the name of pseudo-croup, or false croup, to the same affection, which he was careful to separate from true croup in the article on this subject in the *Dictionnaire de Médecine* (1835). From this time on, the details of the disease, and the treatment, received special attention from men of the highest standing in the profession. Many new points were brought up, and diphtheria being generally recognized and admitted, the distinction between croup and false croup, the simple, primitive, and secondary pseudo-membranous manifestations, were entered in all the medical works as accepted truths, if not as demonstrated facts. Some of the questions may be merely mentioned here, viz: nervous affections during the disease, and after convalescence; the examination of the false membranes, both chemical and microscopical; the discovery of albumin in the urine (1857). But what attracted most attention from medical men was the treatment, medical and surgical, of this fearful disease. The first thing was the

general abandonment of blood-letting; the second, the rejection of all so-called specifics; thirdly, the adoption of the sustaining treatment; and lastly, tracheotomy.

Tracheotomy, after having been opposed by the most bitter opposition, denounced by some and ridiculed by others, was sustained by the test of experience, came out of the contest victorious, and "remains mistress of the field."—(*Simon.*) The period for the operation, formerly left till the last extremity, was placed beyond all controversy by those having most experience, at the much more favorable time, viz., at the commencement of asphyxia. But notwithstanding the constant reports and the undeniably favorable results in France, still in parts of Germany, in England, and in many parts of our own country the operation has been regarded and acted upon too much in the light of a "last resort."

UNITY OR DUALITY OF CROUP AND DIPHTHERIA.

On the question of the unity or duality (complexity) of the cause or causes of croup and of diphtheria, the profession is divided, even respecting the true membranous form of croup. The majority of practitioners of the present day believe in the identity of croup and diphtheria (Cohen), and I believe the number is increasing. Of the unitists we may mention the following names: Sir Thomas Watson, Hellier, Bristow, Sir Wm. Jenner (recently converted), the long list of distinguished Frenchmen, Meigs and Pepper, S. Bard, Jacobi, Pilcher, our own H. A. Johnson, R. G. Bogue, and many of the members of this Society, including, I believe, partly, our worthy President.

Of the dualists there are the names of Charles West, Aitken, the Germans generally (though fearfully confused), Wood, Flint, J. Lewis Smith, Barker (though he believes in the croup of diphtheria), Cohen, and many of the members of this Society so profess.

This is a question very difficult to settle by the exact methods; and it is no less important than difficult, for as a man's theory is, so may his practice be inclined almost inevi-

tably, though not necessarily, provided clinical observations demonstrate a given course of treatment to be generally, or even largely, successful. But this question cannot be settled by "the count of heads, or the clack of tongues." I might fill pages with illogical inferences and irrelevant statements on this point, from the writings of distinguished men. We must, however, hold firmly to the facts in this case, as in all others, if we would arrive at safe conclusions. The impossibility of discovering a difference, either *macroscopically*, *microscopically*, or chemically, between the false membranes formed in the different cases, is equally admitted by both sides—Smith, Steiner, Cohen (quoting Virchow also), and Simon, Jacobi, Meigs and Pepper. Again, there is no symptom or anatomical fact observed at the bedside which will enable the physician to say that the case is croup and not diphtheria.—(*Smith*.) E. Wagner has shown, by numerous and searching investigations, that there is no sharp dividing line between diphtheria and croup, an opinion with which Steiner is compelled to agree. The same writer affirms that true croup, as well as true diphtheria, may occur on the gums and throat as well as in the large air passages, but further says that most frequently the two diseases seem to shade into each other; that is, the affection appears on the gums and throat as diphtheria, in the upper part of the larynx as diphtheritic croup, and in the lower part of the larynx, in the trachea and bronchi, as croup.

In speaking of the starting point of the exudation, Steiner uses the following language, strange for a dualist:

The exudation occurs sometimes in the form of true croup, and sometimes in a diphtheritic form, but the wretched confusion and uncertainty which still prevail among physicians in regard to the theory and nomenclature of these two processes would make it difficult to collect statistics showing their relative frequency; moreover, it must be frankly confessed that it is not always easy during life to make a clear diagnosis.

And there is no essential difference in the false membranes as they form in the different parts of the respiratory tube, except that as a rule they become less fibrous and more corpuscular or purulent as we descend towards the lungs, until the

croupous bronchitis has changed into a purulent or muco-purulent one.

J. Lewis Smith, in his report on this subject, made to the International Medical Congress, 1876, discussed the question under three heads:*

I. Croup a local malady; diphtheritic laryngitis the expression or manifestation of a general disease.

II. Anatomical characters identical in kind, as regards the state of the larynx, but differing in degree or intensity.

III. Clinical facts which indicate the duality of these two diseases.

At the close of Dr. Smith's paper a discussion followed in the medical section of the Congress, participated in by quite a number of the members, and the result was the adoption of the following resolution:

In view of the wide diversity of opinion existing in regard to the relationship of diphtheria and croup, the section prefers to recommend the paper of Dr. J. L. Smith for publication, with an expression of their opinion of its high value as an important contribution to the literature of the subject, but without a definite expression of opinion upon the point at issue.

In *Composition*, the false membrane is made up of (1) amorphous material, (2) molecules, (3) cells, (4) fibrillæ. In locality, it is found mostly on the naso-pharyngeal and the respiratory mucous membranes, but exceptionally it may be found on any of the mucous membranes, or on denuded surfaces of the skin anywhere.

MICROSCOPICAL EXAMINATION.

(1) The *amorphous material*, which is the basis or cement, so to speak, is more or less transparent and viscid, holding together the morphological elements.

(2) The *molecules* are of various forms and sizes, from a mere point to quite an appreciable size and regular form. They include (1) the elements of decomposition and disintegration of a purely chemical character, but not fat; (2) vibri-ones, bacteria, monads, micrococci or coccobacteria, as they have been variously termed; (3) vegetable germs and my-

*See my full report.

celia—*zygodesmus fucus* (Letzerich ; see also *St. Louis Med. and Surg. Journal*, 1872, p. 214.) ; (4) fat globules, round, of various size, and soluble in ether and oil of turpentine.

(3) The cells are of the pavement epithelium or of the cylindrical and ciliary variety, (dependent upon the part from which the pseudo-membrane is taken,) granulated corpuscles, blood and pus corpuscles.

(4) The *fibrillated portion* consists of very fine striations, sometimes sufficiently parallel to give the specimen an appearance almost fibrous, at others they are crossing or reticulated in every direction.

CHEMICAL EXAMINATION.

Chemical examination of the false membranes seems to prove conclusively that the exudate is of a fibrinous character, though it is often spoken of as a fibro-albuminate. It is insoluble in hot and in cold water ; it is contracted and condensed by acids, and dissolved by alkalies. Of the latter, the chlorate of soda has been shown by numerous experiments to possess a solvent power twice as active and more prompt than any other agent of this class.—(*E. Barthez*.) Lime water is also known to possess considerable solvent power, for which purpose Küchenmeister has recently brought it into therapeutical application.

The little red spots on the under surface of the false membranes, as well as on the denuded surface of the mucous membrane, are not the products of vascularization, but spots of bloody points caused by rupture of minute vessels. They had been regarded as the organization of vessels in the false membranes. The microscope, however, has shown that to be incorrect. They are minute coagula of blood, adhering closely to the separated surfaces. The epithelium is generally removed from the mucous membrane, and in exceptional cases there is ulceration.

HISTOLOGY OF CROUP.

The manner in which the false membrane is formed has been explained in two ways :

1. The endogenous cell action by which the epithelial cells become enlarged and their contents multiplied, and thus form the molecular and morphological elements of the false membrane, while at the same time these epithelial cells send out projections or offshoots which by coalescence form the matrix or network of fibrilæ among which the other elements become entangled.

2. The extravasation or transudation of amorphous and of morphological elements from the vessels of the mucous membrane, the amorphous, albuminous or fibrinous portion becoming coagulated, stratified and striated, and thus forming a basis and network for the morphological elements.

In my opinion, both these theories are partly true. But I have no doubt the extravasation has the preponderance. And the coagulation is dependent upon the essential cause of the disease—as much so as the peculiar products of variola or measles are dependent upon a peculiar poison.

LARYNGOSCOPIC APPEARANCES.

On account of the impossibility, in most cases, of making use of the laryngoscope in small children, from a want of co-operation on the part of the patient, the report of Münch, as given by Steiner, is of decided interest in several respects. The patient was a boy ten years old :

“The mucous membrane was much reddened ; a marked membranous deposit covered the ary-epiglottidean ligaments, and still more copiously the vocal cords ; the glottis was narrowed, partly by the deposit upon the vocal cords, and partly by the paresis of the dilator muscles, the posterior crico-arytenoid. Later the whole larynx appeared to be covered with membrane ; at the same time it was noticed that the edges of the vocal cords were apparently agglutinated to each other at various points by a layer of fluid exudation. Subsequently the deposit disappeared under the continued use of caustics, but was renewed daily until finally only a thin, gauzy layer of membrane was noticed, which returned again and again with great obstinacy, especially upon the vocal cords. The vocal cords ultimately resumed their function, and manifested considerable vibratility, even while some of the membrane remained. By the sixteenth or seventeenth day the normal white color of the vocal cords was restored, and here and there a reddish streak was all that could be noticed.”

Ziemssen has also noticed the exudation, the swelling of the vocal cords, and their immobility. See also Niemeyer, French transl., Vol. I. p. 26.

COURSE.—It may be added here that croup is an acute disease, of rapid progress, increasing in severity to the acme or to the fatal termination, with sudden and transient remissions, depending upon the expulsion of false membranes or other temporary causes.

The DURATION is short—from three to four days; some cases, however, may die sooner, and some continue for several days, or even, exceptionally, run into weeks, as I have seen. The duration is influenced by the age, the strength of the patient, previous condition, and the *genius epidemicus*.

Before we accept the opinion of any writer on the termination of croup, we must know what, precisely, he means by the term croup. Every writer of distinction testifies to the high mortality of this disease as we have defined it. “It is, under all circumstances,” says Steiner, “a deadly disease, and the prognosis is in general doubtful. * * The proportion of recoveries is stated by all writers of honesty and diagnostic skill as lamentably small.” The termination of croup is most frequently death.—*Simon*. In the majority of cases croup ends fatally.—*Churchill*. Two-thirds die.—*Marley*. *Vieusseux* says one-half died (in his early practice, 1775). Two out of three die.—*Michaelis* and *Bard*. In membranous croup recovery rarely takes place.—*Pilcher*. The great fatality of croup is admitted by all.—*Burker*.

At Hospital Sainte-Eugenie, of 160 cases treated medically, 58 recovered and 102 died. As with the duration, so with the final result; the attendant conditions—age, previous condition, epidemic influence, hygienic advantages, treatment and complications will have much to do with determining the results.

THE MANNER OF TERMINATING.—As the case approaches the fatal termination the suffocative attacks are less intense, on account of diminishing ability of the part and of the system to recognize and to resist them; drowsiness becomes increased, the

dyspnœa continues and increases, the pulse becomes small, weak, thread-like and very frequent, and death is ushered in under one of two forms: (1), either by asphyxia from the local obstruction to respiration, with accompanying symptoms, viz.: cyanosis and more or less of convulsive movements; or (2) by general prostration, as exhibited by the general indifference, pallid, waxy countenance, loss of expression, and death resulting from carbonic acid and diphtheritic poisoning.

If, however, the case should have a *favorable termination*, the characteristic symptoms become ameliorated, the dyspnœa is less embarrassing, the cough more moist, the suffocative attacks are farther separated, the countenance ~~is~~ ^{becomes} more natural, and the pulse slower.

In the convalescence the physician must bear in mind the fact that dangerous symptoms of various kinds may arise, such as the nasal twang, aphonia, difficulty of swallowing, restrained respiration, which may be caused by paralysis of the different parts to which these symptoms point; and indeed the nervous lesion may extend to almost the entire body.

PARALYSIS FOLLOWING DIPHTHERIA.—From statistical documents carefully compiled, the proportion of cases of paralysis following diphtheria is about one-sixth. But it must be remembered that many of the recovered cases are not seen long enough to know whether paralysis follows or not, and many die before the supervention of this accident; hence, Roger estimates the proportion affected as from one-fourth to one-third of those who do not die in the first part of the disease proper.

DIAGNOSIS.

Under the head of "Symptoms" the capital points in the course of croup were set forth sufficiently in detail. It will only be necessary to point out some symptoms and circumstances by which croup may be distinguished from some other diseases with which it has been confounded. The disease most nearly simulating croup is catarrhal laryngitis, laryngitis stridulosa, or false croup.

The symptoms in this latter disease are of milder degree generally. The attack comes on suddenly, in the night, frequently without any warning. The voice is seldom entirely obliterated, though it may be hoarse and rough. False croup is not preceded by membranous angina, though croup is not always ushered in by this angina.

False croup partakes in its manifestations very much of the nature of acute laryngitis. The suffocative attacks are early in the disease, and frequently in the beginning, and soon occur at longer intervals, and are of less intensity; while the opposite is the course with croup, the symptoms progressing instead of diminishing. There is no expulsion of false membrane in false croup; neither does *asphyxia* appear, though temporary suffocation may occur.

At the beginning, when there is a moderate degree even of dyspnea and aphonia, it is not always safe to pronounce positively what the future may develop. The whole history will develop the true character of the case, but prophesying is seldom profitable before data are presented.

Acute, grave cases of laryngitis have many of the same symptoms as croup. But the former often follows some other acute disease, such as small-pox, or measles, or scarlatina, and then may be regarded as secondary. In some cases making an accurate diagnosis will require very careful observation, and even then a positive opinion may not be based upon sufficient evidence. The presence of false membrane on the mucous surfaces, or expectorated, is regarded as pathognomonic of croup.

PROGNOSIS.

To what I have said under "Termination" may here be added that the prognosis is always doubtful, and should be given with great reserve.

Simon reports, from 1826 to 1840, 3,845 cases, of which only 961 recovered, and 2,884 died, that is, one recovered out four cases.

From 1841 to 1858 the numbers rose to 6,876 cases, of which

1,146 recovered, and 5,730 died, viz: one out of six cases. Tracheotomy has added greatly to the favorable issue.

Under prognosis Steiner says:

Out of quite a large number of cases occurring in my practice, *before I had adopted the practice of tracheotomy*, I saw but three recoveries. Since 1863, however, this discouraging rate has been so much improved by the employment of tracheotomy that the mortality has at different times amounted only to sixty, sixty-five and seventy per cent. Bricheteau states it at sixty-nine, Franque at sixty-eight, Trousseau at fifty, and Greve, in Sweden, at twenty-three per cent.

I will return to this feature of the case under "Tracheotomy." "Finally," says Simon, "as a general rule, we should never lose hope of saving our patient."

THE TREATMENT

Very naturally divides itself into Medical and Surgical.

MEDICAL TREATMENT.

The study of the therapeutics of croup during the last fifty years, or even from the beginning of the present century, justifies us in abandoning the claim of any agent as a specific in the treatment of this disease, whether local or general.

Blood-letting, mercurials and alkalies, as having a decidedly beneficial effect, have also fallen into disfavor with the profession. Bromine, syrup of copaiba, and cubebs, and especially sulphate of copper, have their advocates. The latter has been recommended by numerous authors of distinction, and it still holds considerable reputation in this country, through the writings of the late Niemeyer. Samter, who studied its action carefully, comes to the following conclusion: When emesis still follows its administration, he doubts not the propriety of this treatment for croup; but when this action is no longer produced, paralysis is supervening, and it is proper to operate.

Its depressing effect, added to that of the disease, will not be a favoring condition for the success of tracheotomy, while nothing has been gained beyond what would have been accom-

plished by less exhaustive agents. It is given in from one-fourth to one grain doses, repeated frequently.

The syrup of copaiba and cubebs has been given with reported success by Trideau, and was recommended by a physician in Washington City, in the transactions of a medical body of that city. It has not met the expectations of its advocates, at least yet, though it seemed to promise well in the cases attacking the larynx first.

Tincture of the chloride of iron (tinct. ferri perchloride) has been in use since 1858. It was brought to the notice of the profession about the same time by Heslop, of England, by Gigot, Aubrun, and Jodin, of France, and by Crichton, of Scotland, and its application in croup and diphtheria was probably suggested by its previous use in the treatment of erysipelas. It has been used locally and generally, singly and in combination, and it has to-day the confidence of the profession above any other single remedy for the membranous diseases, and approaches nearer to the rank of a specific.

EMETICS.—English, French, Germans and Americans are in accord as to the great value of emetics in some form. Tartar emetic, formerly much used, has been replaced by less depressing agents, especially in the case of young children. It is still given in combination by a respectable number of practitioners. I must here add that if it should be chosen, its effect must be carefully watched, otherwise irreparable damage will be done by it. I prefer other means, for it must be admitted that the principal effect of an emetic in this disease is mechanical; hence, that which produces the most prompt and efficient action, with the least depression or other objectionable effects, is the one to be chosen. Simon prefers the syrup of ipecac, with five or ten grains of the powder added to each dose when a decided effect is desired.

Steiner prefers ipecac in combination with tartar emetic, “a

powder containing two grains of ipecac and one-sixth of a grain of tartar emetic, and five grains of sugar, to be taken every ten minutes " till it operates. " If diarrhœa be present, or if it follow the administration of this prescription, I select the sulphate of copper." This is very significant language, and carries with it the intimation of the danger which I have mentioned. Ipecacuanha is perhaps the most generally approved emetic by the four nationalities referred to. Within the last ten years, through the recommendations and published reports of Prof. Fordyce Barker, the turpeth mineral (hyd. sulphas flav.) has grown rapidly in favor with the profession of this country. It acts promptly, efficiently and kindly. I have been so well pleased with its action as to prefer it to all others. It is given in three to five grain doses, according to the age of the child, and repeated in fifteen ^{or} twenty minutes if the first dose does not operate. It is not deemed well to repeat it more than once in the twenty-four hours, or even at a longer interval. Through the teaching of the late Prof. C. D. Meigs, alum in powder has been much used, both by the profession and in domestic practice. I have seen it more than once entirely fail to produce the desired effect—^{emetic.} It is given in teaspoonful doses, mixed with syrup or honey, to be repeated in a quarter or half an hour if it does not produce vomiting. To increase its efficiency, powdered ipecac may be added to it.

Quinine was used in the treatment of croup as early as 1848, by Puls. As an antiseptic it is altogether probable that in the early stages of the disease its action is by contact with the morbid products. As an antipyretic and tonic it may be used, as Dr. Fordyce Barker suggests, in combination with verat. viride very beneficially in the advanced stages. As one of the chief remedies in uncomplicated croup it is not so much relied on as it is in the febrile stages of catarrh and pneumonia.

The local treatment must receive careful attention. *The external applications* may be either cold or hot. If the former

be chosen, with a view to reduce a simple inflammation, their applicability is *especially*, and may I not say only, in the beginning and early stage of the disease. The applications should be made by means of cloths wrung out of cold water and applied to the anterior part of the neck, and covered with a dry towel. They must be frequently repeated. They may be continued while symptoms of active, acute inflammation continue. These conditions will frequently not be present to any marked degree, and the long continued application of cold without corresponding local reaction will have an injurious rather than a beneficial influence. This will be the case if the inflammation is of a decidedly diphtheritic character. Hence, as a rule, where the larynx is involved, I prefer the *hot application*, made by the same method, viz., compresses wrung out of *hot water* and applied to the external throat; or by means of a sponge, as recommended by Dr. Lehman, of Torgau, frequently repeated until the surface is quite red. This is also applicable to the first stage.

RÉSUMÉ OF THE MEDICAL TREATMENT.

1. Give an emetic—turpeth mineral from three to five grains; ipecac, in syrup or powder, or the two combined; sulphate of copper, from a fourth to a grain every half hour or till it produces free emesis; powdered alum with syrup, either alone or combined with ipecac; compound syrup of squills, that is, tartar emetic in this form—(hive syrup), from one-third to a teaspoonful, repeated every half hour until vomiting is produced. The above remedies are preferred in the order in which they are stated. If the catarrhal character should be suspected, an anodyne might be given with propriety, to quiet the system until symptoms were sufficiently marked to decide the case.

2. Tincture of iron and chlorate of potassium or sodium, in solution, with glycerine :

℞ Tinct. ferri muriatis, - fl 3 iss—3 ij.
 Potassii vel sodii chloratis, - - 3 i.
 Glycerinæ, - - - fl 3 i—3 iss.
 Aquæ q. s. ad, - - - - 5 iii.

Dose, a teaspoonful every half hour or hour. It may be farther diluted if required.

3. Regulate fever with tincture of veratrum viride.

4. Local application to the external throat of hot applications, frequently repeated (cold may be used in the beginning by those who prefer it); also counter irritation with turpentine.

5. Disinfectant or antiseptic gargles or washes to be used according to demands, for the throat or nose. Carbolic acid, from two to six grains to the ounce of water; or the above solution of iron, potash and glycerine; or lime-water 5 ij, chlorate of potassium 3 i, glycerine and water each 5 i, may be used with the spray apparatus, according to one's preference.

6. Inhalation of steam by keeping the atmosphere of the room saturated, or, in addition to this, by means of some special apparatus; breathing the steam from slacking lime, or inhaling the spray of lime-water, repeated every hour or two.

7. Sustain the patient's strength by easily digested, nutritious diet (preferably milk), given at suitable times and in proper quantities. Give cold or warm drinks as preferred by the patient, guarding the quantity so as not to disturb the stomach.

8. Treat complications according to general principles. Daily remissions may be met with antiperiodics with great benefit; finally, when medical means fail, as they often will, resort to the *ultimum refugium*—tracheotomy—before it is too late.

SURGICAL TREATMENT.

In this branch of the subject under consideration, it will not be expected that the report shall cover more than the most im-



portant points in practice ; neither would it be especially profitable ; yet enough must be given, it seems to me, to show the status of the operation of *tracheotomy*, and its recent history to its present position in practical medicine. Those of the profession who have not given the subject much investigation would be somewhat surprised at much of the illogical argument offered against the operation in croup, to be found in some of our standard surgical works published only twenty-five years ago. (Velpéau's Oper. Surg., by Mott, Townsend's notes).

As we might very naturally have supposed, and as history has shown, tracheotomy was known and practiced at a very early date in medical history.—*Simon*.

AMERICAN REPORTS.

In Dr. Cohen's report from various sources, published and unpublished, there were 325 operations with 84 recoveries, 25 4-5 per cent. There were over forty operators [1874].

Dr. L. S. Pileher, of Brooklyn, reports [1877] from 36 operators, himself included, 121 operations, 24 recoveries ; 20 per cent.

*Dr. A. Jacobi (New York) has performed the operation about 200 times ; 68 operations (reported), 13 recoveries ; 20 per cent.

Dr. Wm. Porter (St. Louis) 17 operations (mostly in London), 4 recoveries ; 23½ per cent. One of the 4 returned to hospital in two weeks, and died of pneumonia, perhaps a sequel.

Dr. John H. Packard (Philadelphia, 1878), 6 operations, 1 recovery ; 16 2-3 per cent.

Prof. E. Andrews' report of his own and other cases, 21 operations, 4 recoveries ; 19 per cent.

*New York *Medical Record*, February 17, 1877. Since 1868, has saved but a small percentage of suffocating children,—*Am. Jour. Obs.*, February, 1878.

LIST OF CASES ON WHICH TRACHEOTOMY HAS BEEN PERFORMED IN THE STATE OF ILLINOIS, FOR CROUP OR DIPHTHERIA.

No	NAME.	AGE.	CAUSE.	RESULT.	RESIDENCE.	OPERATOR.	DATE.	REMARKS.
1	Henry Kohn.....	4 yrs.	Croup, memb..	Im'ed'te relief. Recv'd	Beardston.	Dr. J. G. Erhardt	May 16, '71.	Wore the canula eleven days before sufficient air would pass through the larynx.
2	P. McDonald...	5 yrs.	Croup, memb..	Im'ed'te relief: died of broncho-pneumonia on 5th day.	"	" "	Aug. 31, '72.	Operated fourth day of disease. Breathed comfortably till third day after operation.
3	W. Lohmann (boy)	2 yrs.	Croup, diph..	Died.....	"	" "	Dec. 8, 1873	Operated seventh day of disease. Too long delayed; died in a few minutes.
4	Willie Schwaer.	5 yrs.	Croup, memb..	Recovered.	"	" "	Dec. 15, '73	Immediate and permanent relief; removed canula sixth day.
5	J. Friese (girl)...	5 yrs.	Croup, memb..	Died.....	"	" "		Relief of dyspnea immediate. Died third day, of pneumonia. In all cases, laryngo-tracheotomy. Dr. Erhardt has operated twice since, in St. Louis, for diphtheria, with bad results.
6	Willie Winston...	8 yrs.	Croup, diph. ...	Recovered.	Forreston, Ogle Co.	" L. A. Mease..	Sept. 28, '75	Had been ill with diphtheria eight or ten days. Partly chloroformed. Extreme condition. Tube removed tenth day. "Patient snatched from the jaws of death."— <i>Dr. Winston.</i>
7	Clyde Shonte (boy)	3½ y.	Diphtheria, followed by croup	Died.....	" "	" T. Winston..	Oct. 11, '75.	Sick two days. Survived 26 hours. Diphtheria appeared on the lips and extended into the bronchial tubes. Delicate constitution.
8	.....		Croup.....	Died...	Sullivan...	" E. W. Mills..		
9	.....		.....	Died.....	"	" "		
10	Sesena /Doke....	4 yrs.	Croup.....	Died.....	Lovington.	" T. A. Collett	Jan'y 1, '71.	Moribund. Lived twelve hours.
11	Ida May Bunyan.	5 yrs.	"	Died.....	"	" "	Jan'y 7, '77.	Lived twenty-seven hours.
12	Walter Love.....	2y.5m	Croup (laryngitis).	Died.....	"	" "	Jan'y 2, '75.	Lived a few minutes. Moribund when operation was performed. Two or three ineffectual efforts to breathe.
13	Willie Hostetter.	5 yrs.	Croup.....	Died.....	"	" "	April 10, '72	Died almost immediately. Complicated with whooping cough.

No	NAME.	AGE.	CAUSE.	RESULT.	RESIDENCE.	OPERATOR.	DATE.	REMARKS.
14	William Noll...	5½y's	Croup, memb..	Died.....	Virden	Dr. A.T. Bartlett.	Feb. 11, '75.	Unmistakable case. A complete cast of a portion of the bronchial tube thrown up. Lived 48 hours. Operated on 2nd day of disease.
15	Alice Blaney.....	5 yrs. 4 mos	Croup.....	Died.....	Norwood ..	" J. P. McClannahan.	March 5, '77	Low tracheotomy. Lived 14 hrs. Died of asphyxia, the disease having continued down the trachea.
16	Gussie Bartlett...	1 year 9 m.	Croup.....	Died.....	Jerseyville	" John L. White	May 6 1883.	Operation too long. delayed. Improved for an hour. Cause of death general congestion of lungs, rather than filling up of the trachea. Tube not suitable. Complaining two or three days.
17	Frankie Baxter..	4 yrs.	Croup.....	Recovered.	Chicago...	" R. G. Bogue ..	Feb. 21, '74.	Tube removed the 16th day. Chloroform was given.
18	Josie Moses(boy)	4 yrs.	Croup, diph...	Recovered.	"	"	Mch. 27, '74.	Tube retained 120 days. Had been sick about 8 weeks with diphtheria before operation.
19	Brice Miller, "	5 yrs.	Croup, diph.	Died.....	"	"	Dec. 15. '74.	Lived 12 hrs. Cause of death, probably syncope. Had been sick about one week. Child insensible during the operation.
20	Emma Kerga ..	3 yrs.	Croup, diph...	Died.....	"	"	Feb. 10, '76.	Lived 32 hrs. Chloroform was given. Had been sick with diphtheria over a week. Died from extension of the disease into the lungs.
21	— Sussman....	2½y's	Croup, diph...	Died.....	"	"	Apr. 29, '76.	Lived 24 hrs. Died from a commencing pneumonia. Gave little chloroform. Sick with diphtheria several days.
22	Larry McMullen.	5½y's	Croup, diph....	Recovered.	"	"	Aug. 27, '76.	Tube removed the 11th day. Chloroform was given. Had been sick two or three days.
23	— Rossene....	2y 2m	Croup, diph....	Died.....	"	"	Nov. 12, '76.	Lived 18 hrs. Chloroform was given. Died of lung complication.
24	Charley Kennedy	3½y's	Croup, diph....	Died.....	"	"	Feb. 5, '77.	Died 4th day, of ashenia and accumulations in the trachea below the tube.
25	Maud Stanley....	3 yrs.	Croup, diph....	Recovered.	"	"	Apr'l 21, '77.	Removed tube on 5th day, on account of ulceration. Chloroform was given. Prolonged convalescence; recovered perfectly. Had had diphtheria several days. Severe case.
26	Willie Kerfoot...	10 yrs	Croup, diph....	Died...	"	"	June 23, '77	Sick 6 days; lived 10 hours. Malignant case. No chloroform.

No	NAME.	AGE.	CAUSE.	RESULT.	RESIDENCE.	OPERATOR.	DATE.	REMARKS.
27	Edward Cross...	7 yrs.	Croup, diph...	Recovered.	Chicago....	Dr. R. G. Bogue..	Aug. 27, '77	Sick for ten days previously. Tube worn 44 days. Chloroform was given. Granulations in the wound gave some trouble.
28	Willie McCoy....	7y 2m	Croup, diph...	Died.....	"	"	Oct. 10, '77	Died on 16th day, of pneumonia, and 10th day after tube was removed. Gave chloroform.
29	Baby Wasserman	2y 2m	Croup.....	Died.....	"	"	Oct. 12, '77	Gave little ether. Lived 24 hours. Died of broncho pneumonia. Had been ill 36 hours.
30	Mary Donahue...	3 yrs. 11m.	Croup.....	Recovered.	"	"	Oct. 22, '77	Ill 24 hours. Gave chloroform. Tube retained 21 days.
31	George Healy....	7 yrs.	Croup, diph...	Died	"	"	Dec. 5, 1877	Lived one day. Gave chloroform. Died from accumulation of membrane and mucons in the trachea and bronchi. Had been ill of diphtheria several days.
32	Mabel S.....	5 yrs.	Croup.....	Died.....	Grafton, Jersey Co	" E. L. Herriott	Oct. 15, '76	Had been sick about six days. Gave chloroform. Lived five hours. Died from the filling of the trachea with exudations. Tube a piece of No. 12 gum catheter.
33	Master Dawson...	2 yrs.	Croup.....	Died.....	Fremport..	" L. A. Mease ..	Mch. 13, '75	Ill 10 or 12 days. Gave little chloroform. Moribund. Died in 15 minutes
34	David E. Bealy Jr.	3y 1m	Croup, diph...	Recovered.	Jerseyville.	" H. Z. Gill.....	Mch. 22, '77	Had been complaining 4 or 5 days. Gave no chloroform. Removed the tube on 6th day.
35	" " "	3y 3m	Paralysis mus cles of glottis	Recovered.	"	"	May 11, 1877	Difficult inspiration for about a week. Gave chloroform. Wore the tube for — months.*
36	Mattie Cummings	19½m	Membr. croup..	Died.....	Bunker Hill	" Fer'd Brother.	Nov. 8, '71	Had been ill 40 hours. Lived 6 hours. Immundate cause of death prostration.
37	Martin Rohan...	50 yrs	Edematous laryngitis	Died.	Madison Co	"	Jan. 31, '73	Had been ill 38 hours. Lived 45 hours. Cause of death, bronchitis.
38	Emma Hauschild	17 m	Diphtheria....	Died.....	Maconpin "	"	Feb'y 5, '78	Had been ill 72 hours. Lived 1 hour. Cause of death, collapse, possibly hastened by hemorrhage.
39	— Lancaster.	3 yrs.	Croup, memb...	Died.....	Cairo.....	" H. Wardner...	Feb'y 27, '68	Had been ill about 8 days Lived 12 hours. Died of exhaustion. No anaesthetics.
40	Fred Launsbury	13 m	Croup, memb...	Recovered.	"	"	Dec. 15, '68	Had been ill 11 days. Wore the tube 128 days. Muffled voice remained. No anaesthetic. A little tumor of granulations would drop into the fenestra, and at times prevent breathing.

*Tube still remaining in, Sept., 1868.

No.	NAME.	AGE.	CAUSE.	RESULT.	RESIDENCE.	OPERATOR.	DATE.	REMARKS.
41	— Harman.....	4 yrs.	Croup, memb..	Died.....	Calro.....	Dr. H. Wardner.	Mch. 12, '73	Had been ill about 8 days. Lived 36 hours. Death caused by pseudo-membranous bronchitis. No anæsthetic.
42	Nellie Gobble....	3 yrs.	Croup, memb..	Recovered.	Girard, Ill.	Drs. R. S. Cowan and R. J. Mitchell	Jan'y 8, '74	
43	Mary Walter....	5 yrs.	Croup, diph....	Died.....	"	Dr. R. S. Cowan	Dec. 15, '77	Lived three days. Cause of death, bronchitis.
44	Minnie Fish....	4½ y.	Croup, memb..	Died.....	"	" "	Jan. 15, '78	Lived four days. Cause of death, bronchitis.
45	Mary Voigt.....	13 yrs	Croup, diph....	Recovered.	Peoria.....	" F. Brendel...	Dec. 3, 1865	Had been ill several days. Last visit Dec. 23. Case reported by Dr. R. Roskoten.
46	Albert Bremwall	3 yrs.	Croup, memb..	Recovered.	Chicago...	" H. A. Johnson	—, 1873	Ill several days. Insensible from asphyxia. No anæsthetic. Had malignant scarlatina four years after, without unpleasant effect from the operation, and recovered.
47	Bertha Bremwall	.....	Diphtheria as a complication of scarlatina.	Died.....	"	" C. W. Earle..	—, 1876	Immediate relief of dyspnœa. Died in two hours, of exhaustion from general disease.
48	E. Stapp (girl)...	12 m.	Diphtheria, laryngeal complication.	Died.....	Washington Co.	" Jas. Phillips..	—, 1861?	Ill several days. Was in articulo mortis. Respiration was entirely relieved. Lived 12 hours. Death from pneumonia. No anæsthetics.
49	Nannie Keegan	3 yrs. 10m.	Diphtheria....	Died.....	Chicago...	" E. W. Lee....	Aug. 29, '77	Sick three days. Used chloroform. Lived 30 hours.
50	John Phalon...	4 yrs.	Diphtheria....	Died.....	"	" "	Oct. 18, '77	Sick 10 days. Asphyxia imminent. Gave chloroform. Lived 2½ days. Died by asphyxia.
51	Clara Nolan.....	7 yrs.	Membr. croup[?]	Recovered.	"	" "	Oct. 22, '77	Two weeks complaining. Chloroform. Artificial respiration necessary after the operation. Removed tube sixth day.
52	Matthew Curran.	4 yrs.	Membr. croup.	Died.....	"	" "	Nov. 17, '77	Sick 36 hours. Lived 2½ days. Died by exhaustion. Chloroform.
53	Eddie Nolan....	4 yrs.	Mem. croup [?]	Died.....	"	" "	Nov. 23, '77	Sick five days. Chloroform. Lived 13 hours. Died of exhaustion.
54	Elice Turcell....	3½ y.	Mem. croup [?]	Died.....	"	" "	Dec. 7, '77	Sick four days. Lived four days. Died from asphyxia. Chloroform.
55	Mich'l O'Rourke	2y 2m	Membr. croup..	Recovered.	"	" "	Mch. 18, '78	Sick 2 days. Removed tube 4th day. Chloroform.

No	NAME.	AGE.	CAUSE.	RESULT.	RESIDENCE.	OPERATOR.	DATE.	REMARKS.
56	Bertha Nelson...	4 yrs.	Diphtheria....	Recovered.	Chicago. ...	Dr. C. T. Parkes.	July 4, 1877	The disease showed itself the day following the operation & wore the tube 4 months. Retention of tube caused by "exuberant granulations," destroyed by nit. arg. solid. Chloroform.
57	.....	6 yrs.	Memb. croup..	Died.....	Mendota..	"E. P. Cook. ...	Spring, 1884	Lived 54 hrs. Chloroform. "Dernier resort."
58	.....	4 yrs.	Memb. croup..	Died.....	"	" "	.....	Chloroform.
59	.....	7 yrs.	Memb. croup..	Died.....	"	" "	.....	Chloroform.
60 } to } 65 }	.....	.....	Four of croup, not epidemic; 2 of diphtheria epidemic.	Died.....	Jackson's	"David Prince.	.....	First four fatal from subsequent pulmonary engorgement. Last two fatal from apparent extension of the disease to the bronchial subdivisions.
66	Richardson (boy)	5 yrs.	Diphth. croup.	Died.....	Clinton, De Witt Co.	"John Wright.	Nov. 20, '77	Three days sick. Died on table. Another, younger, child died of diphtheria in the same family 3 days later; was a favorable case had it been done early instead of moribund. Anæsthetic, ether.
67	Leinhardt Koot..	9 yrs.	Memb. croup..	Recovered.	Freeburg, St. Clair Co.	"F. Koerberlin.	Nov. 17, '77	Three days ill. "Patient with blue lips and staring eyes." Removed cannula 6th day. On 4th day after operation the aphonia disappeared. Pulse 140 half an hour after operation. Second day after, in evening, temperature rose to 108°.
68 } to } 83 }	.....	.....	Croup and diphtheria.	4 recovered 12 died.	Chicago. ...	"H. A. Johnson	.....	It is possible that No. 46 is included in these 16.

Taking the whole number as eighty-three (83), and the recoveries as twenty-three (23), the per cent. of recoveries is twenty-seven and seven tenths (27.7), a very fair result considering the desperate nature of many of the cases.

The most successful operators, in considerable numbers of cases, are: Dr. R. G. Bogue, 15 cases with 6 recoveries—40 per cent.; Dr. H. A. Johnson, 16 cases, with 4 recoveries—25 per cent.; Dr. E. W. Lee, 7 cases, with 2 recoveries—28.5 per cent.

TWO OPERATIONS OF TRACHEOTOMY IN THE SAME PATIENT,
WITH AN INTERVAL OF FIFTY-ONE DAYS.

CASE 1. David E. Beaty, Jr., aged three years and one month, of certainly medium constitution, and decidedly bright mentally. Was called to see him March 20, A. M., 1877. Previous to this date, as early as the 14th, he had a little fever, and in the evening had a chill, for which on the 15th some quinine was given. On the 16th was hoarse, but did not complain of sore throat. On 17th and 18th the hoarseness continued, but the child seemed not to be affected so as to attract special attention or create alarm in the minds of the parents, they having gone to church on the 18th. On the 19th, hive syrup was given by home prescription. He had some appetite, but diminishing for two or three days before I saw him. I found him entirely aphoneous, having an extremely dry, ringing cough; respiration not much embarrassed, fever slight, thirst marked, submaxillary glands somewhat enlarged [said to be so usually]. On examination of the throat, found some small spots on the tonsils, and on the posterior wall of the pharynx a patch about half the size of the finger nail; tonsils a little red. I at once expressed a decided opinion of the gravity of the case; gave an emetic of turpeth mineral, which acted promptly and well; left a solution of muriated tinct. of iron and chlorate of potash to be used as a frequent drink, and a solution containing quinine grs. x., tinct. opii. gtt. viii, with aromat. sulp. acid q. s., aq. $\bar{3}$ i, a teaspoonful every two hours. I also left tinct. veratrum viride to be given in case there should be perceptible fever.

The father, coming home after I left, began to realize the serious nature of the case, and Dr. J. L. White, their former family physician, being in Jerseyville, was requested to see the case in consultation.

On examination of the case in the afternoon, the patches were not visible. Other symptoms were no better. Voice completely obliterated; wheezing audible at quite a distance.

Dr. White calls it membranous croup, but thinks not diphtheria, though he might "call it diphtheritic croup." Adopted the same treatment as in the case of Julia Neumeyer [a severe case treated in February], viz., hot applications to the neck, high temperature of the room, and the atmosphere saturated with moisture, the previous treatment to be continued. Dr. W. thought it as favorable a case for recovery as could be of the membranous form of the disease. The perfectly dry, ringing cough in conjunction with the wheezing respiration made the case to me one of much anxiety.

On the 21st, at 9 A. M., found the respiration much obstructed; had had a bad night; several severe paroxysms of approaching suffocation were reported as having occurred during the night. The characteristic symptoms were steadily progressing, with loud, dry, wheezing respiration. Gave the turpeth mineral, which was followed by moderate emesis and some relief. Continued the chlorate of potash and iron; also the quinine, at two or three hours interval. Suggested the probability of tracheotomy becoming necessary. The reply was to do what I thought to be best.

3 P. M.—Condition no better. All the indications for tracheotomy growing stronger. Suggested to have everything ready to operate at any time during the night.

At 5 P. M., spoke to Dr. Shobe of the probable necessity for the operation during the night. Applied vapor from vinegar and water, created by hot bricks in a bucket at foot of bed under the bed clothes.

7 P. M.—Still worse; respiration very difficult; depression of the ensiform cartilage and lower ribs very marked on inspiration; evident carbonization of the blood. Dr. S. was sent for. I prepared for operating. Before the doctor arrived there was a sudden marked relief following a fit of coughing. The operation not now thought to be imperative; indeed, not justified at the moment by the symptoms. The doctor remained an hour, then returned home; I remained all night. Temperature of the room maintained at 85°, and vapor continued.

22nd.—Respiration most of the night tolerably easy, after the sudden relief last evening, until towards morning, when it gradually became more difficult. Left for home at 8:30 A. M., expecting to return at 11 A. M. A messenger soon came, and Dr. S. was notified. At 10 A. M. the effort at inspiration was terrible to witness. Imperfect oxidation was present, but not strongly marked, except at one time during a severe paroxysm. I regarded the operation as absolutely necessary, if any more paroxysms should occur. Dr. S. thought the operation very doubtful, regarding it now as very late. We agreed to try the vapor from slacking lime. Little or no benefit followed. The father desired, if necessary, other council from a distance, and proposed to telegraph Dr. Armstrong of Carrollton, to come on the 5 P. M. train. This was readily agreed to, conditionally; that is, if necessity required the operation, we should proceed to operate at any time, and not wait; for I had no expectation the child would live till evening without surgical relief. We were to remain and be ready for any emergency. Two points were clear in my mind: (1) Progressive aggravation of the symptoms; and (2) imminent danger of suffocation. [See conclusions.] Towards noon the symptoms became more alarming, but no paroxysms occurred. We concluded that if no improvement began by 1 o'clock, P. M., we would operate. By the time dinner was over, the obstructed respiration had become still more marked, and the danger of suffocation imminent. Delay was no longer safe. I proceeded to operate, Dr. Shobe kindly assisting. The effect of the imperfect oxidation of the blood was plainly visible in the color of the fingers and face, and also in the general anæsthetic effect. Gave no anæsthetic. Some of the family and neighbors rendered efficient aid. I marked out the line of incision with dots of ink. Operated slowly and cautiously, after the first principle incision using forceps and the handle of the scalpel freely, pressing the vessels aside with blunt hooks. The inferior (median) thyroïd vein was directly beneath the inferior portion of the first incision, and distended

to the size of a crow quill. Not a vessel required ligation. I believe there was no misstep in the operation. The hemorrhage was somewhat embarrassing. The thyroid gland was scarcely observed, and at most not to annoy. Opening the trachea would have been, perhaps, a little easier had it been held with a tenaculum, though it was *thoroughly cleared before the incision was attempted*. At this point considerable self-control is needed to prevent haste in opening the trachea before the dissection is completed. The neck was quite short, and the usual amount of adipose tissue was present to obstruct the operation. The opening was dilated by means of a bent loop of wire, while I cleared the trachea of a considerable amount of thick, tenaceous mucus and lumps of false membrane, with the curved forceps. After this the tube was introduced without difficulty. The relief was perfect from the time the incision in the trachea was dilated and cleared, the child falling asleep almost as though fully under the influence of an anæsthetic. In fifteen minutes the respiration was 40 per minute, and in an hour down to 36.

The demand for water was most urgent and persistent; and it was quite necessary to limit the supply in order to prevent disturbance of the stomach, there being an unfavorable disposition to nausea. Examined the urine in a spoon, but could not say there was albumen in it. On the second day after, I found a trace of albumen, examined in the same way. The early part of the night was spent with considerable comfort by clearing away the tenaceous material as it was forced into and out of the tube, using the curved forceps to remove any obstructions, and occasionally removing and cleansing the inner tube. About 10½ P. M. there occurred a severe fit of coughing, and the tube was soon filled with mucus and membranes, and respiration for the time was arrested. Fortunately I was near at hand (though taking a little rest, having been up the most of the two preceding nights), and quickly removed the inner tube, also removed with forceps the additional mucus and membranes, thus relieving the obstruction to such an extent as

to restore the respiration. I would remark here that I found it almost necessary to leave the inner tube out after that, during the night, it then being possible to clear the outer tube frequently with the curved forceps when necessary. I watched him pretty closely the remainder of the night, but found the obstruction increasing towards morning, and by 7 o'clock he appeared to be sinking from some impediment to ~~aration~~ *æ-* *nothing in the tube.* With the needed assistance I removed the outer tube, cleared the trachea thoroughly of all mucus and hard, tough lumps of false membrane; all of which restored the respiration and rescued the child from impending death.

Prostration was decided, and the child greatly exhausted. When commencing to change the tube the father (before perfectly courageous and apparently hopeful) said, "The child has been dying for the last twenty minutes."

A profound and prolonged sleep followed, after which our patient began taking some nourishment, more than at any time before. Frequent fits of coughing, however, occurred, in which the same kind of material as before, was brought up, and sometimes quite considerable lumps, thick, deep yellow or dark yellow, were thrown out with considerable force, and at other times, brought out with the forceps; but it was evident that the material was losing its consistency and toughness. A part of the day he was quite cheerful. Towards evening the obstruction increased. I removed the ~~inner~~ *outer* tube, applied an 80-grain solution of nitrate of silver to the edges and surface of the wound, used a spray upon it of a 40-grain solution of carbolic acid, cleared the trachea, and replaced the tube. In the early part of the night I gave a saline cathartic (Rochelle salts), there being considerable fever, and at 10 P. M. and 10³⁰ P. M. gave one drop of tinct. verat. viride. After the second dose he vomited slightly; was very restless, tossing about constantly. The excessive thirst continued. About midnight the cathartic acted, and he became less restless. Towards morning I began using a weak solution of salt and water, pouring a

few drops into the tube,* which seemed to soften the material and facilitate its expulsion very much, greatly to his relief. He took nourishment sufficiently. I did not replace the inner tube during the remainder of the night; the outer one seemed to transmit the air and the secretions much more freely, and the curved forceps could be used to better advantage.

24th. Patient is restless only at times; wants to drink too much water. There is an eruption on the upper part of the chest, and before noon it appeared on the palms of the hands also. At noon, while sleeping, the respiration was 48 per minute, having ranged from 45 to 50 during the last twenty-four hours. The discharge seems rather reddish. At 5 P. M. pulse 135, respiration 50, temperature 102°. Removed and cleansed outer tube, which could be easily done; re-applied the 80 gr. sol. of nit. silver; used the carbolic acid spray freely. There was some albumen in the urine. Having remained with the case for forty-eight hours (constantly since the operation), I now took my leave for twenty-four hours, Dr. S. remaining in my absence.

25th, 1 P. M.—The inner tube required to be removed several times during the night; there seemed also to be more fever. The secretion is reported to have been bloody. Appetite poor.

8 P. M.—Respiration 36 per minute, and almost inaudible; he sleeps quietly, and more than at any time since the operation. Omit now the vapor. Keep the temperature of room at 75°.

26th—Removed the tubes; cleansed the wound with soap suds. The inferior thyroid vein had become impervious to circulation, and apparently dead, and I removed it with the scissors. After severe fits of coughing there is a little hemorrhage from the lower part of the wound.

27th—Removed the outer tube and left it out more than an hour; then replaced it. On account of my not remaining at

* See Gurdon Buck, New York *Medical Record*, 1872, p. 12.

the house, Dr. S. remains to-night. Keep the temperature at 75°. Gave any kind of nutritious food desired.

28th—Nothing special occurred last night; removed the tubes permanently this forenoon. Saw the child twice only, on the 29th and 30th, and once a day till April 6th, excepting the 5th, and again on the 9th, when I find the last of my notes to the following effect: "Wound nearly closed; air escapes through the wound only on coughing; speaks aloud with little effort; appetite good." From this date I was absent from home nearly two weeks. But nothing occurred to produce any anxiety until the night of May 6th.

CASE II.—I then saw him again for the first, and found inspiration difficult, especially so when sleeping or resting, and in the latter part of the day and night. This condition has shown itself for some days, but when he was thoroughly awake and playing, it attracted but little attention, and produced but little embarrassment. On the 7th he was quite bad. Prescribed for him, but did not see him again, there being considerable relief, till May 10th. The obstruction from this time became more and more marked, and the *inspiration steadily more difficult when drowsy or sleeping*. Remedies seemed to produce little or no effect. This condition continued, becoming gradually more aggravated, but without apparent paroxysm, the expiration, so far as I could judge, being little, if at all, obstructed. I remained with my patient during the nights of the 10th and of the 11th, prepared and expecting to be compelled to perform tracheotomy the latter date. At times, the child being very weary and sleepy from the long continued and laboring effort at breathing, there would be several fruitless attempts at inspiration, and until he would arouse himself and take a deep, forced inspiration. Even this condition grew worse, and I presented strongly the only remedy which offered any hope, viz., tracheotomy. This was reluctantly received inasmuch as it seemed to appear to the parents that the other operation had not cured the child.

My opinion of the nature of the case in this second attack,

or sequel of the former, may as well be stated here: I regarded it as a *paralysis of the muscles of the glottis* (the dilators particularly), or at any rate, a loss of balance between the dilators and the contractors, possibly spasm of the latter. I expected immediate relief by opening the trachea, and did not intend to let the child die without the operation, unless I should be opposed or overruled. My convictions were clear as to the course to be pursued. Dr. J. L. White was telegraphed to come in consultation, the parents thinking the child would not get well, but desired to leave nothing undone. Fortunately, the Doctor got a train immediately, and was here sooner than expected. I need scarcely say that after an examination of the case, together with the history of it, there was a perfect agreement as to the course to be pursued. We proceeded to operate about 11 A. M., *fifty-one days after the first operation*. There was some anæsthesia already present from imperfect æration of the blood. The Doctor, however, preferred chloroform as the anæsthetic to be given. Patient took it slowly, of course, on account of the imperfect respiration, hence more was required to produce the desired effect, which was guarded and limited. I operated rapidly, being guided by the line of the previous incision. There was no hemorrhage to embarrass; yet with all possible haste, the child had ceased to breathe before the tube was introduced. I quickly inserted it, had the feet elevated high, inflated the lungs through the tube several times, and thus restored respiration, which soon became regular. The secretion thrown out of the tube was mainly mucus.

I took no notes of the case after this operation, for some weeks; and there was nothing of special importance to require note in the recovery from this operation. Saw the patient daily for some time. Gave various forms of tonic treatment, cod liver oil, and substantial diet. Perhaps I should have remarked that the voice was not affected in this latter difficulty or attack. In the latter part of May the respiration seemed to be entirely clear, with the tube in.

JUNE 20.—“Cannot sleep with the tube out if the opening

in the trachea is entirely covered and closed. The same difficulty as formerly exists *with inspiration*."

JULY 5.—Began the local use of electricity and stimulating applications to the glottis. These were continued for some time, but with apparently not much benefit. During August and September the child was visiting in Iowa or Wisconsin. On his return I thought he seemed decidedly improved in general condition. On the way home, however, they stopped at Bloomington, and Dr. White had an opportunity of seeing him again. The Doctor suggested having a fenestra made in the tube, which I had done, with apparently some relief. This continued with little change, he being comparatively comfortable and well otherwise, till November. At this latter date the tube was left out all night, I staying with him till after midnight. There was no special or considerable disturbance. The next day, November 3, the parents wanted the tube in again, not having expected to leave it out altogether. We found very considerable difficulty in re-introducing the tube; indeed we found it impossible to introduce the same tube, which was of uniform diameter the entire length. I introduced a bit of sponge covered with a very thin piece of rubber tissue attached to a wire, and leaving that in an hour or more. I then introduced another tube, which had a gradually increasing diameter, the lower end being about the size of the other tube. The parents were fearful something might occur, and have kept it in, except to remove and cleanse it, until the present, September 25, 1878.

OPINIONS OF THE JUSTIFIABLENESS OF TRACHEOTOMY IN CROUP, DIPHTHERIA, OR OTHER DISEASES.

Dr. Samuel D. Gross : "In diphtheria, as in croup, tracheotomy is seldom a successful operation, and still it is, in my judgment, in many cases a highly proper one. Even when it cannot save life it should often be performed to prevent impending asphyxia, and thus afford the patient a more easy mode of death."

Erichsen : "It is as unpermissible for a surgeon to allow a patient to die of laryngeal asphyxia without an attempt at relief by opening the windpipe, even though life appear to be extinct, as it would be to let him

die of hemorrhage without attempting to contract the bleeding vessel. In diphtheria, as in croup, tracheotomy may be performed when the patient is in imminent danger of death from laryngeal obstruction.'

Dr. Frank H. Hamilton : "Tracheotomy in diphtheria, under well-defined conditions, is no longer a question of doubt, but justifiable."

Oertel : "Tracheotomy in diphtheria is indicated only when the local affection preponderates."

F. C. Skey : "We do not pretend to be governed by the presence of this or that form of disease, but by the pressure of symptoms, which, if imminent, demand artificial opening, to whatever class they belong or in whatever region they originate. * * With such symptoms [naming them], and with threatening suffocation, the surgeon has no alternative but that of operation [tracheotomy]."

Mason **Waxton :** In the advanced stage of the disease [croup—acute laryngitis] medicine, I fear, can effect but little. But surgery may be more successful. * * This [tracheotomy] is one of the triumphs of the healing art."

"When the distinctive symptoms declare that the exudative disease [diphtheria] is present in the larynx, the question of tracheotomy is forced upon our attention. * * These two points ascertained [laryngeal exudation and advancing severity], the sooner the operation is done the better."

Aitken : "The evidence, however, is daily accumulating which shows that tracheotomy ought to be resorted to much oftener, as a remedy for croup, than it has been, and at a *much earlier period of the disease*; not as a last resort, when death from asphyxia appears imminent, and after treatment of the most depressing kind."

Niemeyer : "However great the number of failures [in tracheotomy], it is not admissible in any case not to undertake the operation if the other remedies do not give us results."

Cohen : "That tracheotomy saves many croup patients from death, otherwise inevitable, and that, too, even under unfavorable circumstances, there has long been no reason to doubt. * * The indication for the operation exists whenever it is apparent that death from suffocation cannot be averted by any other means."

Dr. Austin Flint.—His answer to the question is the same as his answer to the other question, "Are lives ever saved by it?" "Though the chances for success might be ever so small, the operation should not be withheld."

Pilcher : "Tracheotomy is indicated in all cases of croup in which laryngeal stenosis becomes so great as to become an element of danger, either immediately, by rapid suffocation, or by a more gradual asphyxia."

Prof. H. A. Johnson: "Tracheotomy, or laryngotomy, should be performed in all cases of threatened asphyxia from causes which cannot be speedily removed by other methods, as, for instance, * * 4. Acute inflammation, simple or diphtheritic, producing so much obstruction to respiration as to materially diminish oxygenation of the blood."

A. W. Barclay, St. George's Hospital: "Our chief resource for prompt relief to breathing is tracheotomy. Justifiable in diphtheria where the dyspnœa is so urgent as to throw other symptoms into the shade."

Druit advises tracheotomy for threatened asphyxia from croup or diphtheria.

R. G. Bogue: "Tracheotomy should be resorted to in all cases [membranous croup and diphtheritic croup the same] where death is threatened by suffocation from obstruction in the larynx, and as soon as the breathing has become insufficient to sustain the vital powers."

Steiner.—Of tracheotomy he says: "No other means fulfill these indications [to establish a new provisional air-passage and assist nature in her efforts to cure] so certainly and so directly."

Trousseau believes the operation should be made, no matter what degree of asphyxia has been reached.

Mr. Spence: "The practitioner should not be discouraged by reason of repeated failures to save life by tracheotomy."

Simon: "If, after using these [medical] means, the croupal affection progresses, the attacks of suffocation increase, if asphyxia commence, it is necessary to decide to perform tracheotomy. * * Tracheotomy remains mistress of the field for all cases of croup which the medical treatment cannot arrest."

Fordyce Barker: "I have often found it necessary to recommend the operation in consultation, and have seen several cases of recovery after the operation."

A. Jacobi: "Of its value I am convinced."

E. W. Lee: "I think it ought to be done, no matter how desperate the condition."

All these are among the latest and highest authorities on the subject. To multiply the number would be easy, but the sentiment would be the same. Hence, if authorities have any weight, if there is any argument in language, or evidence in facts, the justifiableness of tracheotomy in croup and the duty

of the medical attendant to have the operation performed are demonstrated propositions in medical science to-day.

For further particulars of the *operation*, the after-treatment, the accidents in the operation and subsequently, etc., etc., see the full report. I have given the detailed case somewhat fully because it covers most of the points in a majority of the cases, and many not in ordinary cases.

CONCLUSIONS.

1. Membranous croup is not necessarily a fatal disease, except in the epidemic form.

2. Its essential nature is, in the vast majority of cases, identical with that of diphtheria, though the means at our command, as thus far applied, are not sufficient to *demonstrate* this proposition.

3. The general treatment of diphtheria, so far as applicable to croup, gives better average results than when the latter is treated as simply an acute inflammation.

4. The treatment most generally approved and giving the best results is : (1) emetics having the properties of promptness and efficiency, without producing depression of the system, turpeth mineral and ipecac being preferred ; (2) tonics and disinfectant remedies, viz.: tinct. chloride of iron, and the chlorates of the alkalies, in full and frequent doses, and the same classes of remedies applied to any visible manifestation of the disease ; (3) the local application of steam by inhalation, or the vapor from slacking lime, or the spray of freshly prepared lime water. Treat the fever and remissions respectively with veratrum and quinine.

5. Support the vital forces by an easily digested, nutritious diet.

6. Treat complications according to their general nature.

7. *Tracheotomy* is an established operation for all cases of

"croup" not amenable to medical treatment, in which laryngeal stenosis is the chief, or one of the chief, elements of danger.

8. The operation should be resorted to in the latter part of the second stage, or early in the third; the earlier the operation the larger will be the per cent. of recoveries.

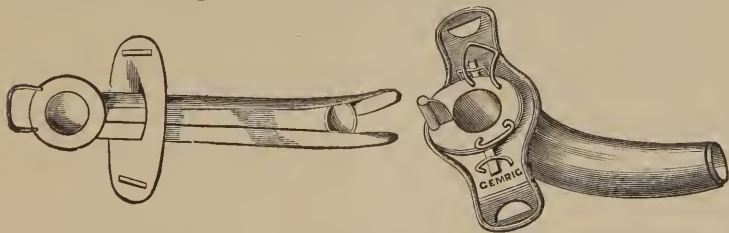
9. The only contra-indications to the operation are, (1) generalized diphtheria, which must, then, be of severe degree, and be largely the cause of the predominant symptoms, and (2) clot in the heart. "It is never too late to operate while the child is not positively dead." (*Archambault.*)

10. The obligation resting on the physician to give the patient the benefit of the operation is imperative. He may not withhold it directly nor indirectly; the patient or the friends may forbid it, and thus relieve the physician.

11. The operation should be performed deliberately and carefully; exceptions, when the emergency is great, and cessation of respiration about to occur, or having occurred.

12. The trachea should be thoroughly exposed before any attempt is made to open it. Exceptions as above. Opening the trachea with a stab is a dangerous procedure. The trachea should be cleared of obstructions with the tracheotomy forceps, or with the suction tube, before the introduction of the canula.

13. The ordinary silver double canula, moveable in all directions in the plate, is the best for general purposes.



14. The inner canula should be removed frequently, and both should be removed, cleaned, and the trachea cleared as

often as, and whenever the emergency from obstruction demands.

15. The patient should not be left for the first forty-eight hours without an attendant competent to remove the tubes and any removable obstructions.

16. The canula should be permanently removed as soon as practicable.

17. Many patients are lost from a want of proper after-treatment.

18. Every practising physician should be prepared to perform the operation, or to have it done, whenever needed.

19. An anæsthetic should not be given if there exist sufficient asphyxia to produce appreciable anæsthesia; and whenever given it should be done with the utmost caution.

20. A careful watch should be instituted and continued for some days or weeks, for the accidents of local or general paralysis.

